

REMARKS

In response to the above Office Action, claim 15 has been cancelled. The rejections of the claim under 35 U.S.C. § 102(e) for being anticipated by Nakayama or under 102(b) for being anticipated by EP 1 174 483 are therefore moot.

In the Office Action, the Examiner rejected claims 11, 14 and 15 under 35 U.S.C. § 102(b) for being anticipated by or in the alternative under 35 U.S.C. § 103(a) for being obvious over Iso Mamoru, JP 11-060232, hereafter Iso Mamoru JP'232. Claims 11-14 were also rejected under § 103(a) for being obvious over Iso Mamoru JP'232 further in view of So and Robey.

Method claim 11 includes, in a method for making polishing abrasive particles for use in a final stage of a fine polishing process, the steps of:

- 1) condensing an alkoxysilane in the presence of an acid catalyst to form an alkoxysilane condensate having an average degree of condensation of from 2 to 8 and
- 2) then hydrolyzing the alkoxysilane condensate in the presence of an ammonia or ammonium salt catalyst to form cocoon-shaped colloidal silica as the abrasive particles.

A significant feature of Applicant's claimed invention is the step of condensing the alkoxysilane in the presence of an acid catalyst to form an alkoxysilane condensate having an average degree of condensation of from 2 to 8. When an alkoxysilane is condensed in the presence of an acid catalyst, it is possible to obtain a condensate having the claimed degree of condensation. However, when it is carried out in the presence of an alkaline catalyst, a non-uniform reaction proceeds, producing a product (part of which is colloidal silica) having a broad distribution and no condensate having an average degree of condensation of from 2 to 8 is obtained. Applicant found as

discussed, for example, on page 4, lines 25-29 of the specification, that when such a condensate was first formed the resulting cocoon-shaped colloidal silica not only exhibited excellent performance as abrasive particles, but also had excellent alkali resistance.

This step using an alkoxysilane condensate as a starting material for producing cocoon-shaped colloidal silica is not taught in or is obvious from the teachings of the cited prior art.

Alkoxysilane condensate (for example, tetramethoxysilane tetramer) is produced industrially in order to be used as a binder (inorganic bonding material), a glass film, or another such glass starting material. (These are generally called "bulk starting materials.")

It is disadvantageous if alcohol and other such reaction byproducts are generated in large quantities in these bulk starting materials during bonding. A technique is, therefore, conventionally known in which the amount of alcohol produced as a reaction byproduct is reduced by condensing an alkoxysilane roughly to a tetramer in advance. Specifically, the reason that an alkoxysilane condensate is used in the prior art is that the production of alcohol as a reaction byproduct during the reaction is inhibited.

In contrast, no problems will be encountered if methanol or ethanol is produced as a reaction byproduct when colloidal silica particles (whether cocoon-shaped or sphere-shaped) are synthesized in an aqueous solution in the presence of an ammonia catalyst. There was, therefore, no incentive in the prior art to select tetramethoxysilane condensate or tetraethoxysilane condensate as a starting material for synthesizing

colloidal silica particles, and the inexpensive tetramethoxysilane and tetraethoxysilane monomers were selected.

The present invention is based on selecting as a starting material an alkoxysilane condensate (obtained by condensing alkoxysilane in the presence of an acid catalyst to an average degree of condensation of 2 to 8) conventionally not used and not selected as a starting material for synthesizing colloidal silica particles.

Tetra-alkoxysilane is converted to silica glass via hydrolysis and condensation polymerization, but the catalyst behaves differently depending on whether an acid or an alkali is involved. It is known that an acid catalyst accelerates hydrolysis and causes condensation polymerization to proceed thereafter, whereas an alkali catalyst causes hydrolysis and condensation polymerization to progress simultaneously. (Cited References: (1) Sumio SAKKA, "Chemistry of the Sol-Gel Method," Agune Shofusha, 1998, pp. 154-161; (2) C. Jeffry Brinker and George W. Schere "SOL-GEL SCIENCE" copyright © 1990 by Academic Press, Inc. pp. 212-215). Copies of these documents are being filed in an Information Disclosure Statement filed simultaneously herewith.

In the process in which colloidal silica particles are manufactured by hydrolyzing tetra-alkoxysilane in the presence of an alkali catalyst, excess network structures disappear and microscopic particles are produced because condensation polymerization progresses while -OR are left unchanged around the silicon molecules. In contrast, particulate material is not formed when tetra-alkoxysilane is hydrolyzed using an acid catalyst to obtain silica. In all instances of the prior art, therefore, tetra-alkoxysilane is hydrolyzed in the presence of an alkali catalyst in order to manufacture colloidal silica particles.

On the other hand, -OR groups remain in the interior in the case of colloidal silica particles obtained by hydrolyzing tetra-alkoxysilane in the presence of an alkali catalyst. If the colloidal silica particles come into contact with water after being formed, the -OR groups are converted to -OH groups, and the alkaline resistance of the colloidal particles is reduced. In contrast, only a small number of -OR groups is left behind and the alkaline resistance is unlikely to decrease at the stage in which tetra-alkoxysilane is condensed using an acid catalyst.

The significance of the present invention is the development of a manufacturing process in which the advantages of both an acid catalyst reaction and alkali catalyst reaction are used in combination.

In this regard, the present invention achieves a much better effect in comparison with Iso Mamoru (JP'232).

Comparative Example 1 of the specification according to the present invention is a test example that faithfully replicates the example cited in Iso Mamoru (JP'232).

The following results were obtained when Comparative Example 1 and Example 1 of the present invention were compared.

	Example 1	Comparative Example 1
Grain Size	20 nm x 25 nm	40 nm x 70 nm
Polishing Rate	0.14 $\mu\text{m}/\text{min}$	0.09 $\mu\text{m}/\text{min}$
Surface Roughness	0.177 nm	0.267 nm
Alkaline Resistance	o	x

o means it had good alkaline resistance and x that it did not. This data is essentially set forth in the specification in Example 1 and Comparative Example 1, but if the Examiner would like it submitted by way of a Declaration, Applicant would be pleased to do so.

Colloidal silica having a grain size such as the one in Example 1 generally tends to yield a lower polishing rate with reduced grain size, but a particularly beneficial effect is achieved in the sense that the polishing rate in Example 1 is higher than in Comparative Example 1 regardless of the reduced grain size. In addition, Example 1 has a much better effect in terms of surface roughness and alkaline resistance than does Comparative Example 1.

The Examiner argues on page 4, third paragraph under Section 6, that the use of alkoxysilane condensate rather than alkoxysilane has not been shown to impart patentable distinction to the silica particles. Also, in the fourth paragraph that "To the extent the methods (of the invention) would impart a difference to the materials, said difference has not been shown to be a patentable difference." However, in making these arguments the Examiner is ignoring the comparative data set forth in the specification and discussed at length in the last Reply and again above that the colloidal silica particles produced by the claimed process have superior properties. Nothing is mentioned about this data anywhere in the Office Action.

As set forth in M.P.E.P. § 716.02(a)II, evidence of a greater than expected result or a superiority in a property shared with the prior art is pertinent to the legal conclusion of the obviousness of the claims and can rebut a prima facie case of obviousness. The comparative data set forth in the specification and discussed above clearly shows that the colloidal silica particles produced by the claimed process had superior polishing rate

properties, surface roughness and alkali resistance compared to the product of the process disclosed in Iso Mamoru (JP'232). This it is submitted clearly rebuts any presumption that Applicant's claimed process is obvious over Iso Mamoru (JP'232).

In paragraph 14 on page 9, the Examiner also argues that Applicant's claims do not distinguish the claims from the simultaneous hydrolysis and condensation of the materials in the process of the prior art references. However, Applicant would like to point out that claim 11 specifically recites that first an alkoxysilane is condensed in the presence of an acid catalyst to form an alkoxysilane condensate and "then" the alkoxysilane condensate is hydrolyzed in the presence of an ammonia or ammonium salt catalyst to form colloidal silica. This it is submitted clearly distinguishes the claims from a "simultaneous" hydrolysis and condensation process.

Consequently, it is submitted that the method of claim 11 is neither anticipated by nor obvious over Iso Mamoru JP'232. Nor is it obvious over Iso Mamoru JP'232 further in view of Robey and So, for the reasons discussed on page 7 of the last Reply, the contents of which are incorporated herein by reference.

The Examiner also rejected claims 11-14 under 35 U.S.C. § 103(a) for being obvious over EP 1 174 483, hereafter EP'483 in view of Robey and So.

EP'483 describes abrasive particles in which cocoon-shaped colloidal silica and crystalline silica are mixed together. In the reference the production conditions of the colloidal silica are the same as those described in JP'232. Consequently, the claimed invention differs from EP'483 for the same reasons expressed above with respect to Iso Mamoru JP'232 and is not obvious over EP'483 in view of Robey and So for the same

reasons discussed on page 8 of the last Reply, the contents of which are incorporated herein by reference.

Accordingly, it is not believed that new claim 11 or claims 12-14 dependent therefrom are obvious over EP'483 in view of Robey and So either.

It is believed claims 11-14 are in condition or allowance.

Please grant any extensions of time required to enter this response and charge any additional required fees to Deposit Account 06-0916.

Respectfully submitted,

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